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COLORADO RIVER BASIN WATER QUALITY CONTROL PROJECT

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PROGRESS REPORT

COLORADO RIVER BASIN WATER QUALITY CONTROL PROJECT

Presented at

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Grand Junction, Colorado

December 1965

U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Bureau of State Services
Division of Water Supply and Pollution Control
Region VIII
Denver, Colorado

Colorado River Basin Water Quality Control Project

MAJOR SUB-BASINS
OF THE
COLORADO RIVER BASIN
COLORADO RIVER BASIN
WATER QUALITY CONTROL PROJECT
U. S. DEPT. OF HEALTH, EDUCATION, & WELFARE
PUBLIC HEALTH SERVICE
REGION VIII DENVER, COLORADO
SCALE IN MILES
GREEN
UPPER
MAIN-STEM
SAN
JUAN
LOWER
LITTLE
COLORADO
MAIN-STEM
GILA
WYOMING
UTAH
COLORADO
ARIZONA
NEW MEXICO
CALIFORNIA

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PROGRESS REPORT

COLORADO RIVER BASIN WATER QUALITY
CONTROL PROJECT

December 1965

INTRCDUCTION

The Colorado River Basin Water Quality Control Project was created as a result of recommendations made at the First Session of a joint Federal-State Conference on Pollution of the Interstate Waters of the Colorado River and its Tributaries. This conference was held January 13, 1960 in Phoenix, Arizona under the authority of Section 8 of the Federal Water Pollution Control Act (33 U.S.C. 466 et. seq.). It was called at the request of the states of Arizona, California, Colorado, Nevada, New Mexico, and Utah to consider the pollution problems in the Colorado River and its tributaries. To date five formal sessions of the Conference have been held to evaluate the results of studies conducted by the Project and progress which has been made in reducing pollution.

The objectives of the Colorado River Basin Water Quality Control Project, simply stated, are:

1. To determine the extent of pollution in the Colorado River Basin and its water service area in southern California.
2. To investigate principal sources of pollution in these areas and the contribution from these sources.
3. To determine the effects of pollution on various water uses.
4. To prepare a plan, or plans, for improving water quality in the areas affected.

The Project, as a technical arm of the Conference, is attacking the pollution problems with a staff of 47 employees having capabilities and expertise in many fields. Civil and sanitary engineers, hydrologists,

geologists, economists, radiochemists and analytical chemists make up the professional segment of the staff. In a supporting role are the engineering and instrument technicians, the laboratory aides, samplers, and the administrative and clerical staffs. The Project Headquarters is situated in Denver and coordinates the efforts of the Denver based Engineering and Economics Sections with the Project Field Station in Phoenix, the Field Depot here in Grand Junction, and the Project Laboratory in Salt Lake City. The Project also has technical expertise available to it through its economic contracts for a study of the Colorado River Basin with the University of Colorado and the Economic Research Service of the U. S. Department of Agriculture.

Specific technical assistance in biological, bacteriological, organic, and other sciences are available to the Project through the Division of Water Supply and Pollution Control's Technical Advisory and Investigations Section located at the Robert A. Taft Sanitary Engineering Center in Cincinnati, Ohio. Another resource now developing is the technical assistance and research capability represented by the Division's Robert S. Kerr Water Research Center in Ada, Oklahoma.

Supporting the Project through the vehicle of regular technical sessions are the conferees from the Colorado Basin States. These experts provide sound judgment and advice on pollution study needs, approaches, and individual state policies. An AdHoc Committee, formed in the spring of 1965 and consisting of three of the state conferees, the Federal conferee, and the Project Director, is considering reasonable water quality objectives for the Basin and its tributary areas. The signing of the Federal Water Quality Control Act of 1965 by the President in October of this year makes the work of this Committee vital to the interests of the individual states.

A Consultant Review Panel composed of nationally and internationally recognized experts also provides guidance to the Project through evaluations of methodology and technology. Members of the Panel include Mr. Raymond A. Hill of Leeds, Hill, and Jewett, Inc. of San Francisco, an eminent consulting engineer; Dr. Vaughn E. Hansen, Director of the Utah Water Research Laboratory at Utah State University; and Professor Blair T. Bower, Associate Director of the Quality of the Environment Program for the Resources for the Future, Inc., in Washington, D. C. In addition, Mr. Lloyd Wilcox, former Deputy Director of the U. S. Department of Agriculture Salinity Laboratory at Riverside, California, has been serving as a consultant to the Project on the relationship of irrigation to salinity.

The Project's, program has also been reviewed by the nation's highest scientific authority, the President's Science Advisory Committee, as a part of its designated responsibilities. The Committee's findings cited the soundness of the Project's technical approach and the values which the program will yield in the planning for water quality control in the Colorado River Basin.

Specific mention must be made of the excellent cooperation which the Project has received from various state, Federal, and local agencies and groups in securing pertinent data, and in the joint participation of the U. S. Geological Survey and the Bureau of Reclamation with the Project in the field sampling and analytical endeavors in the Colorado River Basin.

Initially, the conferees emphasized the need for control of the radiological pollution problem associated with liquid and solid wastes that were being discharged into the surface waters of the Colorado River

Basin. This has been accomplished through the coordinated efforts of the Project and its radiological consultant, Dr. Ernest Tsivoglou, the states, Atomic Energy Commission, and the uranium milling industry. A great deal of the early efforts by the Project were devoted to the control of these radioactive waste problems. Today, the radioactive levels in the Colorado River and its tributaries are consistently below the recommended limits of the International Commission on radiological protection. Although these major sources of radioactivity have been successfully controlled, concern was expressed about the uranium mill tailings [redacted] and their potential hazards to man through possible contamination of the River and its tributaries.

At the Fifth Session of the Conference held in Las Vegas, Nevada on May 26, 1964, a specific charge was made by the chairman to the Project to develop a report on the disposition and control of uranium mill tailings piles in the Colorado River Basin. The progress made to date in carrying out this responsibility will be discussed at this meeting.

The direction of the Project's investigations was shifted at the Third Session of the Conference to pollution associated with mineralization, i.e., salinity. Detailed studies involving engineering and economic assessments of the problem are under way and occupy a major segment of the Project's activities at this time.

Our concern for the effects of mineral pollution has not preculuded our concern for all types of pollution. A continuing effort has been made by the Project to identify and evaluate all waste sources including municipal, industrial, mining, and allied activities, as to type and

effect. Action programs and plans for the control of discharges from these sources are needed and will be delineated with the help of the individual states.

Generally, this report will approach the problems of pollution in the Colorado River Basin by looking at the water uses, the waste sources and the control needs.

WATER USES IN THE COLORADO RIVER BASIN

In a complex river basin such as the Colorado River, water must serve a wide variety of uses. [redacted]ater supply for agriculture, municipalities, industries, power and stock watering are continuing necessities. In addition, the demands of today include such uses as fish and wildlife propagation, and water-oriented recreational activities. This latter use includes boating, water skiing, sport fishing, camping, swimming, picnicking, and aesthetics. The Colorado River Basin has tremendous appeal and potential for attracting the water-oriented recreationist.

AGRICULTURE

In terms of physical quantities -- irrigation agriculture -- is by far the major consumptive user of the waters of the Colorado River Basin. As has been dramatized in even cursory reviews of the growth of the West, agriculture played the single, most dominant role. Many of the cities and towns in the West developed as a result of agriculture and today are still oriented to agriculture as the primary industry. Agriculture will remain a very important aspect in the social, political, economic, and physical structure of the West and to the Basin for many years to come. Today, agriculture uses some 90 percent of the available

water in the Colorado River Basin and, even with continued massive immigration, industrialization, and the natural increase in population, agriculture will still use an estimated 85 percent of the available water in the future.

In the past water quantity has been given the primary consideration, but today quality is also recognized as a factor of utmost importance. The vastly improving technology of irrigation agriculture will demand raw materials, i.e., soil, seed and water, which will insure consistently high production. Water with toxic materials, high silt load, sludge particles, an unnatural balance in salts, or even radioactivity will very likely not be able to meet this criterion.

MUNICIPAL WATER SUPPLY*

The Colorado River system supplies about 600 cities and towns within the basin having a total population of approximately 610,000 with approximately 187,000 acre-feet per year of raw water. The per capita use of water in the Basin varies from a low of 150 gallons per day in the Little Colorado Subbasin to a high of 350 in the Lower Main Stem, with an average for the Colorado River Basin of 275. Every city, town, and rural community is concerned about its water supply -- not only its bacteriological and chemical safety -- but also its taste, appearance, odor, and hardness. In many areas the tourist-based economy will demand a water quality which will insure personal physical enjoyment of the regional pleasures, whether it is fishing at Flaming Gorge, boating on Lake Powell, or gaming at Las Vegas. A person who is marginally ill from a dose of salts in his drinking water cannot be expected to enjoy his stay, to return, or to

*Does not include the Gila River Subbasin or out-of-basin water service areas.

tout the praises of the area. To emphasize the importance of tourism, Mr. James A. Golden, Manager, Yampa Valley Electric Association, Steamboat Springs, Colorado, cited a significant statistic at the recent Governor's Conference on Air and Water Pollution here in Colorado. He stated that an area with two dozen tourists a day can equate their effect on the local economy to an industry with a $100,000 a year payroll. According to Mr. Golden, the dollar volume from tourism is almost as great as from agriculture in Colorado. The rest of the Basin States can count on an equally impressive impact from tourism.

INDUSTRIAL WATER SUPPLY

The Colorado Basin supports a variety of water-using industries including meat packing and rendering, food processing, sugar beet refining, pulp and paper production, petroleum production and refining, uranium and other mineral processing, as well as chemical and allied products. These industries use 100,000 acre-feet per year. The future holds a great potential for expansion of industry in the Basin with oil shale in the Upper Basin, phosphate production in Utah and Nevada, pulp and paper in Wyoming and Colorado, and the oil and gas field developments in the Upper Basin as indicators of the trend.

ELECTRIC POWER GENERATION

Hydro-electric power generation has been an economic necessity in development of the Colorado River Basin. [redacted] These generating units rely on minimum power pools in reservoirs to maintain production.

Thermal power generation is becoming more important in the Basin. With large deposits of coal in Utah, New Mexico and Colorado, in particular, pit head

generating units are becoming more common. [redacted] The future importance of thermal generation of power is reflected by the proposed five million kw plant east of Kanab, Utah which has an initial allocation of 100,000 acre-feet of water per year from Lake Powell.

FISH HABITAT

The Colorado River and its tributaries provide habitat for a wide variety of fish. The type and preponderance of the fish population is in large part dictated by the habitat of the stream and its water quality. Factors such as stream depth, canalization, weed growth, food sources, and spawning suitability affect habitat in general. Water quality includes such factors as dissolved oxygen levels, temperature, turbidity, nutrient levels, as well as chemical concentrations.

Trout is the dominant species found in the cold water streams of the Basin. Many reservoirs in the Basin produce a variety of warm water species including crappie, yellow perch, bullhead, white bass, bluegill, walleyed pike, black bass, and others, as well as rainbow trout. To lure the fishermen to these streams and reservoirs, the Game, Fish and Park Department for the State of Colorado planted a total of over 30 million fish during 1964. The other Basin States have comparable fisheries programs.

RECREATION

The use of outdoor recreational facilities is growing rapidly throughout the Basin. The number of camper days in the state and Federal parks has increased tremendously during the last five years. Recreation

is currently one of the major industries in the Basin. The huge reservoirs such as Flaming Gorge, Lake Powell, and Lake Mead, along with the many other smaller impoundments in the Basin, are attracting campers, fishermen, boaters, swimmers, and water skiers in ever-increasing numbers. A large part of the leisure time enjoyed by our society today is being used in water oriented recreation. The improved roads and other means of access to many of these areas will continue to increase the pressure. New facilities at the sites to accommodate these recreationists are multiplying daily. Bacteriological, chemical, and aesthetic qualities of the waters they visit and use are important to the recreationists.

Sports Fishing

Fishing is an important recreational activity in the Colorado River Basin. As an indication of its popularity, a total of 444,000 licenses were sold in Colorado alone in 1964. This represents almost 22 percent of the resident population. The number of enthusiasts fishing the waters of the Basin increases each year.

Boating

The popularity of pleasure boating in the Colorado River Basin is increasing each year. Pressure on the reservoirs in the Basin is indicated by the fact that over 300,000 outboard motors were in use in the Basin and southern California at the beginning of 1964. The ramps at Lake Mead and at Parker, Arizona, for example, are crammed on the weekends and holidays. The Corps of Engineers, Los Angeles District, reported recently that the population at Parker, Arizona on a weekend increased from a normal of 3,000 to as many as 10,000. Pleasure boat marinas and launching ramps dot the Lower Main Stem waterway, and more are being constructed each year

throughout the Basin.

Hunting

The Colorado River Basin may be characterized as one large hunting preserve with some of the largest herds of deer, elk, antelope, bighorn sheep, and bear available for the several hundred thousand rabid hunters which crowd the area in season. In Colorado alone, for example, over 200,000 resident and nonresident licenses were issued during the big game seasons, and another quarter of a million hunt small game and birds. Although the game are not as fastidious as humans, the water on which they rely must be of reasonably good quality. Acid mine drainage, heavy silt loads, oil, toxic materials and other pollutants will drive the game away in search of more palatable waters.

Water Oriented Parks and Aesthetics

The waters of the Colorado River are a focal point for numerous parks and recreational areas. The vast national forests, state parks, monuments, etc., in many instances, relate the visitor to the water resources of the area. An increasing demand for quality water to satisfy these developing recreational uses can be expected.

WASTES DISPOSAL

The river and its tributaries receive and carry away the municipal sewage, industrial, agricultural, mining, and other wastes produced by the varied human activities throughout the Basin. In certain stretches of the Basin's streams, waste disposal has become a dominant water use. Each day, a tremendous volume of waste water, including sewage, industrial process water and cooling water, find its way into the Colorado River and its tributaries.

POLLUTION, ITS SOURCES AND EFFECTS ON WATER QUALITY AND USES

Through various activities, man has changed the natural regimen and characteristics of many streams in the Colorado River Basin and has created pollution problems in some areas that have a serious impact on water uses. Water pollution is often caused by mining and industrial activities, oil drilling operations, municipal waste discharges, and certain agricultural activities. Other intermittent discharges of pollutants, such as accidental spills from storage tanks, oil transmission lines or holding ponds, and wastes from pleasure boats or shore front homes, may have serious local effects, and in some instances may cause temporary excessive pollution in sizeable reaches of surface waters.

MUNICIPAL WASTES *

Tables I, II, III, and IV in the Appendix provide a listing of municipal waste sources in the Colorado River Basin with various degrees of treatment shown.

There are 23 communities with a total estimated sewered population of 41,360 discharging raw sewage to watercourses in the Basin. Thirty-eight (38) communities serving an estimated 32,460 people have only rudimentary waste disposal facilities such as septic tanks, Imkoff tanks, or settling tanks. In the Basin, 110 communities serving an estimated population of 323,980 people provide secondary treatment for the waste water. In addition, some 112 communities with a population of 100 or greater have no organized sewage collection system and only rudimentary individual disposal units.

Many of the well designed and constructed treatment facilities in the Basin are not providing the degree of treatment possible because of

* Gila Subbasin not included

operation and maintenance problems. Much needed in-plant laboratories do not exist or many of those that do exist are not being utilized enough to provide necessary data for treatment control. To date, eleven communities in the Basin serving an estimated population of 57,410 have been observed to have operation and maintenance deficiencies which decrease the degree of waste reduction that is possible.

Within the Colorado River Basin, a total of 53 cities, towns, and districts have received 80 Federal grants in the amount of $4,599,432 for construction of sewage treatment facilities (Table 5). The grant represents only a fraction of the overall cost to these communities of $15,453,707.

The effects of these municipal waste discharges are actually widespread since most sources are physically separate from each other by substantial distances. Stream assimilation of the organic wastes from individual sources may ameliorate the total effect, but within the stretch of stream below the point of discharge of raw or inadequately treated wastes, whether they be organic, bacterial, chemical, or biological, the effects on water quality are measurable.

The biological effects on the stream biota in most cases has not been clearly defined, although it is normal to expect deposition of sludge on the stream bed from raw municipal sources. The sludge blankets the beneficial benthic life and interrupts the normal balance for fish and aquatic life. The extent of effect depends on the volume and concentration of the waste discharged as well as flow, velocity, size and configuration of the receiving stream.

The bacteriological quality of the Basin's waters is of considerable significance to the many users of these waters. Although sewage bacteria

eventually die off in a stream environment, their effect may be felt for many miles. The discharges from the Grand Junction-Fruita areas are an example of this problem. Even though secondary treatment is provided at Grand Junction, the measured coliform densities, including the differential fecal coliforms and fecal streptococci, are high all the way to the Utah-Colorado state line.

At the Water Pollution Surveillance System station near the Colorado-Utah state line, the average coliform count based on 76 samples taken over the past three years is 26,000/100 ml. with a low count of 200/100 ml. and a high of 300,000/100 ml. The State of Utah is in the process of establishing recreational water quality standards. The coliform density suggested is 5,000 MPN/100 ml. It is patently impossible for Utah to require such a regulation within its boundaries if the coliform levels are above that number at the state line. Other bacteriological data at various locations throughout the Basin are depicted on the illustration map and are given in the following tabulation:

Location	Coliform Counts (per 100 ml)		
	Average	Maximum	Minimum
Colorado River near Colorado-Utah State Line	26,000	300,000	200
Colorado River @ USGS Station above Moab, Utah	7,100		
Price River: Price-Wellington-Helper-Castle Gate area	3,000 *		
Lower Colorado River:			
Topock, Arizona	40 **	150 **	0 **
Parker Dam @ Intake	36 **	150 **	0 **
Highway 60-70 Bridge	365 **	1,100 **	25 **
Imperial Dam (behind grill)	485 **	2,400 **	40 **

* Calculated based on degree of treatment and average stream flow.
** Based on 12 samples for 12 month period

The hazards of bacterial pollution are present at every raw and inadequately treated municipal discharge. Secondary treatment, properly operated and maintained, followed by effective chlorination appears to be the minimum requirement for control.

Where necessary, biological and bacteriological surveys of the streams below the various municipal discharges will be undertaken by the Project and its cohorts from the Robert A. Taft Sanitary Engineering Center at Cincinnati in cooperation with the state water pollution control agencies during the coming year. This will provide the individual state water pollution control agencies with quality information necessary to institute control procedures and develop meaningful quality standards.

INDUSTRIAL WASTES*

Industrial activity is spread throughout the Basin with mining, ore processing, milling, food processing, chemicals, and oil production and transmission as the more significant endeavors. The types of industries, products produced, nature of waste treatment provided, and receiving stream are listed in Table 6.

The table does not include data on sewage from plant employees. In most cases, it is assumed that a majority of the plant employees live in surrounding sewered communities and have been accounted for in the previously mentioned municipal sources of wastes. In certain instances, industries which discharge wastes to a stream via a municipal sewer have been included although in most states the responsibility for such treatment is borne by the municipality.

The table does not include information on the specific characteristics of the industrial wastes. Reliable recent data on volumes and constituents of many of the wastes are lacking. Surveys are planned, or underway, in cooperation with the individual states to get definitive information in specific cases. Thirteen plants in the Green River Subbasin in Wyoming, Colorado, and Utah discharge process wastes directly to the waters of the area. Principal waste discharges are from petroleum and coal-washing operations, chemical plants, mine tailings, sawdust and other sediments, and organic matter from food processing.

Twenty industries discharge wastes to the Upper Main Stem Subbasin of the Colorado River. Principal waste constituents are mine tailings, chemical and metallurgical plant wastes, including radioactive substances, and organic wastes from food processing plants.

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* Gila Subbasin not included.

Seven industries discharge wastes to the San Juan River Subbasin of the Colorado River. Principal waste constituents are mine tailings and chemical plant waste products. No important industries are known to discharge wastes in significant amounts to the Little Colorado River.

In the Lower Main Stem Subbasin, several industrial plants are known, or believed, to discharge refuse or waste waters into the Colorado River and tributaries, including a pulp and paper mill, ore processing mills, lumber companies and a produce plant. Surveys of these waste discharges are planned in cooperation with state and local authorities.

The effects of untreated or partially treated waste discharges to particular stretches of the Colorado River and its tributaries can, in many cases, be characterized as producing biological deserts for significant distances. For example, the Game, Fish, and Park Department for the State of Colorado has delineated various river and stream segments in the Colorado River Basin in Colorado which have been adversely affected by such discharges (Table 7). The entire stretch of Ten Mile Creek from the point of the discharge of wastes from the American Metal Climas Reduction Mill to the Dillon Reservoir, [redacted] is devoid of any beneficial fish or aquatic life. Mine tailings and acid mine drainage are the source of wastes affecting the stream.

The waste discharges in the past and today have also made biological deserts of headwater streams of the Animas River. Standard Metals at Silverton, Colorado and the drainage from abandoned mines and tailings piles on the watershed above the plant apparently contribute to this

condition. Heavy metals and toxic materials such as cyanide have been measured in the stream. Tailings piles have eroded and been deposited in the stream bed.

As a result of waste discharges into the Colores River, the Colorado Game, Fish and Park Department reports that the 32 miles below the Union Carbide Uranium processing mill at Uravan, the stream has little or no value as a fisheries resource. The discharge of acid wastes from the Rico-Argentine Mill has made Bear Creek, a tributary of the Dolores River, unsuitable for stocking of fish.

Mine tailings and/or acid leaching affect Red Mountain Creek above Ouray, Willow Creek near Creede, and the Alamosa River.

Old mine tailings pollute significant stretches of the Uncompahgre River below Ouray, the Eagle River in the Minturn area, and the San Miguel River below Telluride.

Oil drilling in the Rangely Oil and Gas Field has polluted Williams Fork and the Yampa River from Hamilton downstream as well as the White River below Rangely.

Wastes from the Grand Valley Rendering plant at Grand Junction and the Western Slope Rendering plant at Olathe contribute organic and bacteriological pollution loads to the Colorado and Gunnison Rivers, respectively.

Fly ash is discharged to the Uncompahgre River by the Western Colorado Power Plant at Montrose. Thermal and/or biological effects on the river have not been determined.

The Holly Sugar Company at Delta discharges beet sugar process wastes to the Gunnison River during the campaign. Two food processing

plants, the Skyland Frozen Food Products Plant and the Speas Vinegar Company at Delta, discharge wastes to the Uncompahgre River through an old municipal sewer. A study of effects of these waste discharges is now in progress.

The Western Meat Packers at Grand Junction and the Brach Packing Company at Fruita on the Colorado River, the Basin Meat Packing Company at Durango on the Animas River, and the Bilsing Meat Processing Company at Craig on the Yampa River contribute organic loads to their respective receiving streams. No detailed survey information is available as yet.

At Steamboat Springs a milk plant and the Highway Locker plant discharge organic wastes to the Yampa River. Details on volumes, concentrations and effects are available and are being obtained from the State Water Pollution Control Agency.

Coal washing wastes from the Knight Ideal Coal Company at Wellington, Utah discharge to Flood Wash, a small tributary of the Price River.

Untreated wastes from the Carbon Dioxide Chemical Company at Wellington discharge to Flood Wash, a tributary of the Price River.

The huge sawdust pile of the Defa Sawmill at Hanna, Utah washes into the Duschene River continually blanketing the stream bed.

Oil well sludge pits on the Duschene River watershed near Brush Creek have been reported to be a source of pollution, according to the Utah State Game and Fish Department.

Untreated waste water from the Barlocker Farms, Inc., a turkey processing plant, discharges to the Virgin River.

In addition to the raw sewage discharged to the Colorado River from the City of Yuma, the Hogue Produce Company discharges wastes from its food products plant, thereby adding to the organic load in the river.

On the Bill Williams River watershed, the effects of discharges from the three ore processing mills at Bagdad remain to be evaluated, although the Bagdad Copper Company is reported to have adequate facilities. Other industrial wastes are reported to originate from the pulp and paper mill of the Arizona Pulp and Paper Company at Flagstaff, Arizona, and the Duke City and Nagle Lumber companies at Winslow, Arizona. Surveys are planned to confirm the facts and to assess the effects of these waste discharges.

Where necessary, the Project staff, with the assistance of the Technical Investigation and Evaluation Section, Robert A. Taft Sanitary Engineering Center, will work with the individual states during the coming year in making definitive industrial waste and biological surveys. This information is needed if meaningful water quality standards are to be developed.

RADIOLOGICAL POLLUTION

The uranium milling industry began in the late 1940's and reached a peak in the late 1950's and early 1960's. Since some of the most extensive uranium ore deposits in the western United States are located in the Colorado River Basin, many of the nation's uranium mills have been located within its boundaries.

In any industry of this magnitude the disposal of the inevitable processing wastes is an ever present problem. Although the mining phase of the uranium industry produces no significant amounts of waste with water pollution potential, the reduction of the ore at the processing mills results in large amounts of both liquid and solid wastes. These wastes are somewhat unique in present day ore processing industries since they contain significant amounts of radioactivity.

This radioactivity stems from a number of radioactive elements that are associated with the uranium in the raw ore. As the ore passes through the milling process, approximately 85 percent of this radioactivity ends up in the mill wastes. Much of the radioactivity ends up in the solid wastes, or tailings, which are usually piled near the mill, while a certain portion of the radioactivity is dissolved in the milling process and is held in the liquid wastes. The disposal of all or part of these wastes in nearby streams was once a common practice, resulting in the transfer of radioactivity to the stream environment.

At the request of various Basin states, the U. S. Public Health Service began collecting stream and mill waste samples in the 1950's to determine the radiological effects of the wastes on the stream environment. In this manner, radioactivity pollution was recognized as a major problem in preserving the quality of Colorado River Basin surface waters.

When adequate data had been obtained to show that uranium milling wastes were indeed creating a radiological pollution problem, a comprehensive program of pollution abatement was voluntarily undertaken by the uranium milling industry in cooperation with State and Federal agencies. This abatement program, consisting of treatment and containment of milling waste products, has been highly successful in reducing radioactive discharges to Basin streams. As a result, current radioactivity levels in surface waters of the Basin are well below recommended limits. It should be emphasized that the uranium milling industry in particular is to be highly commended for its precedent setting efforts toward abatement of a unique pollution problem.

The slowing down of uranium production after 1960 and the resultant closing of a number of uranium mills in the Basin has raised some additional questions for consideration by industry, the Project Conferees, and State and Federal agencies. These questions concern the long term responsibility and control measures for the large piles of solid wastes, or tailings piles, left at the closed down mills.

Much of the radioactivity contained in the tailings piles is very long-lived. For example, radium-226 has a half-life of 1620 years, and thorium-230 has a half-life of 80,000 years, to mention only two of the radioactive elements found in the tailings piles. At a number of mill locations, the tailings piles are subject to slow erosion by wind and water to nearby streams. It is known that some of the radioactivity contained in the tailings is leached from the solids and becomes dissolved in the flowing water when the tailings enter a stream. While the slow erosion of tailings piles into Basin streams will not produce large

scale contamination, there is potential for small continuous amounts of radioactivity to be leached to the streams over a long period of time.

It should be emphasized again, that pollution control measures employed by the uranium milling industry have been very effective in reducing radioactivity in Basin streams to levels well below recommended limits and there currently is no significant immediate hazard associated with uranium milling waste discharges in the Basin. It is the long-lived nature of the radioactivity and the potential for long term, low level contamination of Basin waters that makes necessary a cautious attitude toward the question of ultimate disposition of the tailings piles.

The concept of striving for additional refinement in reducing radioactivity levels in Basin streams, particularly long term levels, is reflected in the recommendations of several national and international professional groups responsible for health protection. One of these groups, the Federal Radiation Council, has made the following statement regarding radiation exposure.

> "There can be no single permissible or acceptable level of exposure without regard to the reason for permitting the exposure. It should be general practice to reduce exposure to radiation, and positive effort should be carried out to fulfill the sense of these recommendations. It is basic that exposure to radiation should result from a real determination of its necessity."

With these considerations in mind the Project Conferees directed the Colorado River Basin Project to prepare a detailed report on the disposition and control of uranium mill tailings piles, in view of their potential for radiological contamination of Basin waters. The report has been prepared and was recently submitted to the Conferees and representatives of the Atomic Energy Commission and U. S. Public Health Service

for comment. All review comments have not yet been received, but are expected in the near future.

The report provides detailed information on the nature and extent of the uranium mill tailings problem, discusses the potential long-term water contamination of the piles, and suggests possible control measures together with estimates of their approximate costs.

The report also provides the following specific recommendations regarding the tailings piles.

(1) That interim measures to prevent the erosion and spread of uranium mill tailings piles be undertaken without undue delay.

(2) That all distribution of mill tailings from either non-operating or operating mills be halted until proper and adequate precautionary review procedures can be instituted.

(3) That discussions be held and binding agreements be reached as soon as possible regarding long term public and/or private responsibility for adequate maintenance of the tailings piles.

Implementation of interim control measures to prevent the spread of the tailings would thereby provide time during which any questions as to river hydrology changes, radiation exposure standards, pile maintenance responsibility, etc., might be partially answered. During this time, beneficial use of tailings that would incorporate adequate disposition might well develop.

In summary, then, the radiological pollution abatement program carried out by the uranium milling industry in the Colorado River Basin during the past six or seven years has been one of unparalleled success. Now that the mills are discontinuing operation one by one, a final

question regarding potential long-term low level contamination of Basin waters from eroding uranium mill tailings piles remains to be resolved.

It is hoped that the Project report to the Conferees, together with tailings pile study programs being carried out by industry and various State and Federal agencies, will be of value in producing a satisfactory solution.

MINERAL POLLUTION (SALINITY)

Mineral pollution, commonly known as salinity, is a problem that is becoming increasingly important in many areas of the Colorado River Basin. The dissolved minerals in the ground and surface waters of the Basin are derived from both natural and man-made sources. Geology has an important influence on the occurrence, behavior, and natural quality of the Basin's water resources. The types of rocks and soils that water comes in contact with determines to a large degree the type and amount of dissolved mineral solids derived from natural sources.

The activities of man result in significant increases in the dissolved mineral solids concentrations in the waters of the Basin. The surface waters of the Basin are used for domestic, municipal, industrial, and irrigation purposes. Part of the water used for these purposes is consumed and part is returned to the streams. The water that returns to the streams contains the dissolved mineral solids that are added during its use for various purposes. The net effect of these uses is that the flow in the streams is decreased and the dissolved mineral solids concentration in the streams is increased.

When water is diverted from a stream for irrigation, part of it is used consumptively by evaporation and transpiration. Most of the dissolved solids contained in the water used consumptively remain in the soils. These dissolved solids must not be allowed to accumulate in the soil and must be leached below the plant root zone to prevent salinity of the soil from reaching a level that would be harmful to plant growth. In order to maintain a favorable salt balance in the soil, an amount of water greater than that required for plant growth is applied to take below the root zone the dissolved solids that were contained in the water used

consumptively. This leaching water is usually returned to the stream system. In its route back to the stream, it may also leach additional soluble minerals from the rocks and soil through which it passes. The return flow, therefore, adds to the dissolved mineral load that was present in the stream from which the irrigation water was diverted. Thus, the dissolved mineral solids concentration in the stream below the discharge points of return flow are greater than they were in the stream at the diversion points.

In addition to an increase in the dissolved mineral solids concentration, the use of water for various purposes may result in a shift in proportion of the various constituents that make up the total dissolved solids.

In the Colorado River Basin, water is diverted and used for various purposes and the used water is returned at innumerable points which causes increases in the mineral content of the streams. The average dissolved mineral solids concentration in the Colorado River increases progressively downstream from less than 75 mg/l[1/] near the headwaters to more than 750 mg/l[2/] in the lower reaches - over tenfold increase. Concentrations of over 3,000 mg/l occur in some streams such as the Dolores River near Cisco, and the San Rafael River near Green River, Utah.

The concentration of dissolved minerals in water is of great importance in determining its suitability for various uses. In irrigated agriculture, the users of water with high salinity concentration must apply additional leaching water to maintain a favorable salt balance in

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1/USGS, WSP No. 1945 (1964. Flow-weighted mean, water year 1962. Colorado River at Hot Sulphur Springs - 73 ppm.

2/USDI, Quality of Water Colorado River Basin, 1965 Progress Report. 21-yr. mean at Imperial Dam, 1941-1961, 779 ppm.

soil, install drainage facilities to handle the leach water and apply more fertilizer to take care of losses due to leaching. All of these factors represent additional costs to the irrigation farmer. In some areas of the Colorado River Basin, water in the streams becomes unsuitable for domestic use during certain periods due to high concentrations of total dissolved solids or high concentrations of one or more of the specific constituents such as sulfate, chloride or nitrate. The U. S. Public Health Service's drinking water standards recommend that waters containing more than 250 mg/l of chlorides or sulfates and 500 mg/l of dissolved solids not be used if other less mineralized supplies are available. Mineralized waters often require costly treatment processes to make them suitable for certain industrial uses. Calcium and magnesium cause hardness in water. Hard water has many deleterious effects on consumers including excessive scale formation in boilers, water heaters and plumbing; increased soap consumption; and accelerated fabric wear. Thus, complex and costly treatment processes are required for excessively hard water to make it suitable for industrial and domestic uses.

The Project is currently conducting detailed investigations on mineral pollution in the Colorado River Basin and the water service areas in southern California. This problem is being attacked through a combined engineering and economics program. The engineering activities include the identification of sources of mineral pollution, the appraisal of the physical and economic effects of mineralization and hardness on the principal beneficial uses of water, and the development and evaluation of measures for abatement of mineral pollution. The economics study is projecting the level and pattern of economic activity for the years 1965, 1980, and 2010 by means of interindustry input-output tables. An analysis of water

quantity and quality as constraints on the level and pattern of economic activity is also under way, using expected water demands for the same years. The analysis of the relation of benefits to costs, based on present and projected future water quality resulting from various combinations of programs for the control of mineral pollution, is an integral element in merging the engineering-economic components.

NUTRIENT POLLUTION

The water pollution aspects of plant nutrient constituents are becoming increasingly important in many parts of the Nation. These nutrients, especially nitrogen and phosphorus, encourage [redacted] growths of [redacted], algae and vegetation in surface streams and reservoirs. The pollution effects of excessive concentration of nutrients, particularly in impoundments, are well documented in some areas of the country. Excessive nutrients and subsequent aquatic growths have, in many instances, resulted in water quality changes that were detrimental to water uses. For example, algal blooms and slime growths cause undesirable taste and odors in domestic water supplies that are costly and difficult to remove. Such growths may also create a nuisance and interfere with the recreational uses of water. It has been indicated that nitrate in water supplies may cause a condition in infants known as methemoglobinemia (blue babies), if the concentration exceeds about 10 ppm as nitrogen.

Nitrogen and phosphorus may reach streams and lakes from both natural and man-made sources. Among the more important sources are municipal and industrial waste water effluents, land drainage including irrigation return flows, application of fertilizers, precipitation, urban runoff, and ground water. Nitrate in water is a final oxidation product of nitrogenous matter. Nitrogen compounds, both organic and inorganic, are converted to nitrates by bacteria. It is obvious that there are numerous opportunities for nitrogen and phosphorus to be added to the waters of the Colorado River Basin.

At the request of Mr. W. W. White, Director of Health & Welfare for Nevada, an Algal and Nutrient Survey

of the Surface Waters of Lake Mead" was made in June 1965 by the Project personnel and biologists from the Robert A. Taft Sanitary Engineering Center. Analysis of samples collected showed that the nutrients entering Lake Mead from Las Vegas Wash were of sufficient quantity to produce algal concentrations exceeding 9,000/ml near the mouth of the Wash. Algal concentrations in the lake decreased with distance from the mouth of the Wash. The highest concentration of algae in Lake Mead were found in the immediate vicinity of the mouth of Las Vegas Wash; however, these concentrations did not interfere with recreational use of water in this arm of the lake. It was concluded that any increase in the amount of phosphorus discharged to Lake Mead from agricultural, industrial, or municipal sources would result in increases in the algal population of the lake.

With the increasing number of reservoirs being developed in the Basin and their extensive use for recreational activities, as well as for domestic water supplies, it is apparent that nutrient pollution may become an important problem. In view of this, the Project has undertaken a program to evaluate existing nutrient data for the surface waters of the Basin. The specific objectives are to: (1) Determine which agencies collect and report information on nutrients, (2) The nutrient constituents that are being sampled, (3) Locations at which samples are collected, (4) The frequency of sampling, (5) The period of time for which nutrient data are available, (6) Which waters in the Basin show high concentrations of nutrients, (7) Areas where additional nutrient data are needed, and (8) Develop a plan for obtaining the desired data.

The Project is actively planning with the Robert A. Taft Sanitary Engineering Center to investigate nutrient sources within the Basin and loads currently being applied to major reservoirs.

OIL POLLUTION

The potential sources of oil pollution in the Colorado River Basin are located in areas where oil is being mined and where there is close proximity of oil transmission lines to streams and lakes. Extensive oil drilling and production operations are currently under way in the Green and San Juan Subbasins. Oil transmission lines are present at many locations in the Basin.

Oil and water are immiscible, and because of this, its pollution effects can never be insidious like those associated with pesticides, salinity, and radioactivity. Oil pollution can be seen on the water surface and as it accumulates on stream banks and boat bottoms. Taste and odor problems in drinking water are produced by very minute amounts of oil. Pollution from oil can eliminate fish from streams and ruin water fowl refuges according to Fish & Game officials. Parts of the Yampa River and its tributaries, as well as the White River below Rangely, illustrate this as they are no longer stocked with fish because of pollution from oil drilling operations in the watersheds of these streams (Table VII).

On April 3, 1965, an oil transmission line broke in the Four Corners Area and spilled an estimated 3,800 barrels of oil into the San Jaun River. Personnel of the Texas-New Mexico Pipe Line Company made immediate arrangements for boats, equipment and clean-up crews and began removing oil from the river on the morning of April 4. The Bureau of Reclamation constructed a log boom and burlap baffle across the San Juan River just above Lake Powell and arranged for the U. S. Air Force to drop a load of baled hay into the river upstream from the boom. Clean-up crews spent several days skimming oil and moving debris from the water as it was trapped by

the log boom. Thus, most of the oil was intercepted and cleaned-up before it reached Lake Powell. [redacted]

Project personnel provided technical consultation on pollution control aspects of this oil spill. They have also had subsequent contacts with Mr. P. A. Lyons, Division Manager, Texas-New Mexico Pipeline Company, regarding this matter. It is understood that his company is planning to install a log boom on the San Juan River immediately below the Aneth Oilfield and develop emergency procedures for operating it in the event there is another spill. In regard to the potential water pollution aspects of accidental oil spills resulting from breaks in transmission lines, Mr. Lyons stated:

> "The possibility of the pollution of water sources is one of the most serious considerations by all pipe line operators and while breaks of the nature of the one under discussion are most unusual and quite impossible to predict, we nevertheless, must always plan for their eventuality. We are presently investigating a variety of means of confining lost oil to small areas should a line break occur in the future."

The Project also participated in resolving another potential oil pollution problem in the Vernal, Utah area. Our particular interest in this case was the oil pollution hazard to a wild life refuge that was soon to be operating in that area. We investigated this problem at the request of Mr. Lewis R. Garlick, Acting Director, Bureau of Sports, Fisheries, and Wildlife, Albuquerque, New Mexico. The problems involved an oil company practice of storing waste oil in dry washes, allowing oil,

in many instances, to be merely wasted on the ground, and clearing blow-off valves and allowing the waste oil to remain in dry washes. It is understood that the oil company involved has taken steps to eliminate most of these potential sources of oil pollution.

The Project will continue to work with the oil industry and the state and Federal agencies in attempting to develop satisfactory abatement and control programs for oil pollution.

RECREATIONAL POLLUTION

The figures cited earlier bear out the impact of recreation on the Basin and its need for good quality water. However, recreational activity is a vector for pollution and can be every bit as important in its effect when compared to municipal or industrial waste discharges.

The needs of the recreationist is a big industry with lodges, camps, marinas, parks, restaurants, etc. established throughout the Basin. Many of these facilities are not located in cities or towns but near the recreation sites. Proper treatment of wastes can be a serious problem.

The recreationist himself contributes not only sewage, but also litter, trash, garbage, oil from motor boating, animal entrails and other detritus from hunting excursions, etc. Education will be the biggest single factor in controlling pollution from these sources.

In the winter-wonderland of the Rockies, the ski resort towns of Aspen and Breckenridge serve as examples of the problems that the heavy influx of skiers have on the respective waste disposal systems. At Breckenridge, the result has been a significant increase in the pollution load to the Blue River. At Aspen, the existing secondary treatment facilities are rendered ineffective during the weekend and holiday periods. The problem is intensified by the proliferation of new lodges and other recreational facilities in the area which are not served by the Aspen treatment plant. The special problems surrounding the treatment of shock loads must be incorporated into the design of plants and in their operation.

In smaller reservoirs and lakes, the effects of motorboating on water quality may be significant. On heavily-used impoundments it has been reported that a scum of oil on the water surface can result from a

day's motorboating activities. Studies at the Robert A. Taft Sanitary Engineering Center on small lakes reveal that a significant increase in organic constituents of petroleum products in the water results from heavy motor boating. The control of these problems rests with better design and operation of the motorboats and a recognition that each reservoir has a critical level for that use. The wastes from cabin cruisers and houseboats has been the subject for control in many states. Sealed head regulations with disposal at approved sites or installation of approved treatment units, usually macerators with chlorination, have been proposed in many areas.

OTHER POLLUTION PROBLEMS

Wastes from Federal Installations*

There are 26 Federal installations in the Colorado River Basin, which discharge 385,000 gallons of wastes/daily to surface waters of the Basin. The President, by Executive Order, signed November 17, 1965, has established the standard of secondary treatment, except in unusual cases, for all wastes discharged from these installations. A nation-wide inventory of disposal practices at Federal installations has been prepared, and many of the facilities have been surveyed and evaluated by the Division of Water Supply and Pollution Control of the U. S. Public Health Service. Immediate follow-up work is planned by the Project to assure that all Federal installations in the Colorado River Basin comply with standards set forth in the Executive Order.

Information pertaining to waste water disposal practices at Federal installations in the Colorado River Basin is summarized in Table VIII.

Sediment Pollution

Sediment pollution is important in many parts of the Colorado River Basin. The natural erosion process contributes large amounts of sediment to numerous streams in the Basin. Various activities of man also contribute to the sediment loads of streams. Among these are improper forest and agricultural land management practices, mining operations, logging activities, gravel washing, and various construction activities. Soil erosion has long been recognized as a serious land problem associated with irrigation. This problem is often intensified by the use of improper irrigation methods as well as poor soil management practices. Erosion

*Gila Subbasin not included.

of irrigated land not only causes economic loss to farmers, but it is a major source of sediment pollution in streams.

Sediment pollution causes impairment of many water uses. Suspended sediment degrades the quality of domestic and industrial water supplies, increases the cost of treatment, and damages equipment. Excessive sediment also causes silting of reservoirs, increases the maintenance costs for irrigation conveyance and drainage systems and is detrimental to fish life and recreational uses of water.

Considerable information on sediment loads in streams of the Colorado River Basin has been accumulated over the years by various states and Federal agencies.

Pesticide Pollution

Throughout the Colorado River Basin, there is widespread usage of various chemicals to control insects and vegetation as well as for other purposes. Some of these chemicals are known to be highly toxic. Where over-applied or carelessly and unwisely used near water courses, they may cause serious pollution problems. In addition, some of these chemicals may be discharged into streams by means of surface runoff and subsurface drainage from the areas to which they were applied. Pesticide pollution has caused important fish kills in streams in many parts of the nation. To date, the only pesticide-caused fish kills reported in the Colorado River Basin have been limited to small, localized areas. In spite of this, some individuals feel that a very real potential pesticide pollution exists in the Basin.

At the Fifth Session of the Conference, the Project was requested to investigate the interstate aspects of pesticide pollution in the

Colorado River and its tributaries. The Project approached this particular problem by analyzing existing pesticide pollution data; through consultation with SEC scientists, and through discussions with representatives of other Federal agencies having responsibilities in this field, such as the Bureau of Sports Fisheries and Wildlife, of the Fish and Wildlife Service. Existing data was considered inadequate for proper evaluation of the problem. In view of this, a field reconnaissance of the interstate waters of the Colorado River Basin was made by the team of biologists and engineers from the Project and SEC. Based upon field observations and existing data, a recommended sampling program was developed for use within the Basin in the event of suspected or actual pollution by pesticides. This program outlines sampling locations, types samples (fish, water, bottom organisms and sediment) to be collected at various locations, and the methods to be employed in collecting and shipping samples.

At the time the sampling program was developed, it was recognized that a tremendous amount of time and competent sampling as well as laboratory effort would be required to obtain the data needed to properly evaluate the potential interstate pesticide pollution problem in the Basin. It was also recognized that data would be needed on the amount of pesticides applied in a particular watershed, place and time of applications, and types of pesticides used. In view of this, it was decided at the Technical Session held in Denver, Colorado in the spring of 1965 that the Project would not undertake detailed investigations of pesticide pollution in the Basin unless it became evident that the problem was becoming more critical.

Specific areas of the Basin which appear to have a pesticide pollution potential at the present time include the Lower Colorado River below

Parker Dam, the Colorado River in the Grand Junction area, and the lower reach of the Uncompahgre River.

APPENDIX

MAJOR SUB-BASINS OF THE COLORADO RIVER BASIN

COLORADO RIVER BASIN
WATER QUALITY CONTROL PROJECT
U. S. DEPT. OF HEALTH, EDUCATION, & WELFARE
PUBLIC HEALTH SERVICE
REGION VIII DENVER, COLORADO

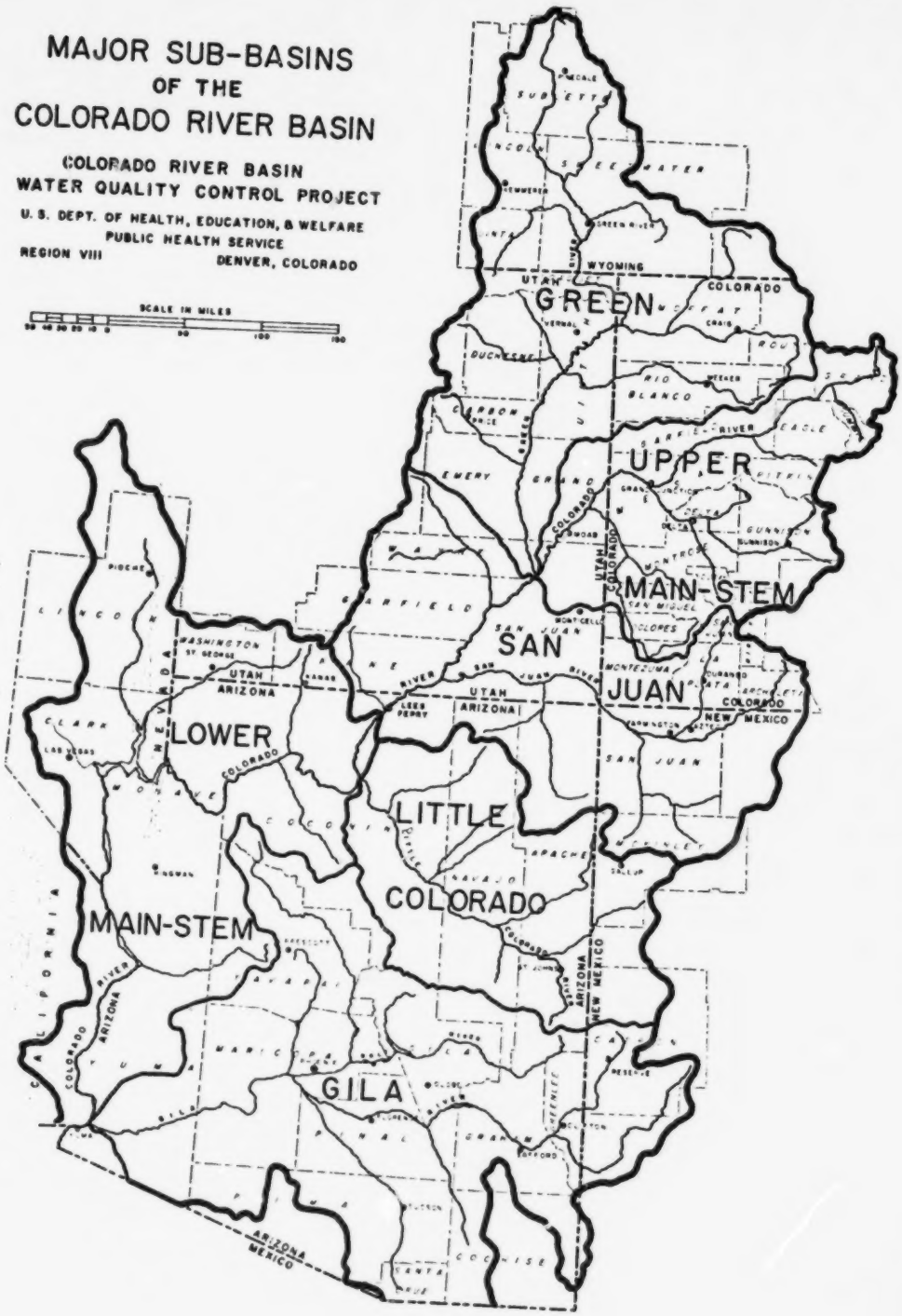

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Table No. 1 (4 pages)	Communities In The Colorado River Basin With No Treatment Facilities December 1965
Table No. 2 (5 pages)	Communities In The Colorado River Basin With Primary Treatment Facilities December 1965
Table No. 3 (13 pages)	Communities In The Colorado River Basin With Secondary Treatment Facilities December 1965
Table No. 4 (1 page)	Summary of Municipal Waste Facilities - Colorado River Basin December 1965
Table No. 5 (6 pages)	Public Health Service Construction Grants Awards For Sewage Treatment Works - Colorado River Basin December 1965
Table No. 6 (10 pages)	Industrial And Mining Pollution Sources In The Colorado River Basin
Table No. 7 (2 pages)	Streams In The Colorado River Basin Where Fish Stocking Has Been Stopped Or Limited Due To Polluted Waters December 1965
Table No. 8 (2 pages)	Waste Water Disposal Practices At Federal Installations In The Colorado River Basin

TABLE I

Communities In The Colorado River Basin
With No Treatment Facilities
December 1965

Community	Estimated Population Served	Receiving Stream	Remarks
WYOMING			
None			
COLORADO			
Breckenridge	275	Blue River	
DeBeque	170	Colorado River	
Eagle	545	Eagle River	PHS Construction Grant made July 1965 for waste stabilization lagoon.
Fruita	1,700	Little Salt Wash to Colorado River	
Hotchkiss	400	N. Fork Gunnison River	
Minturn	660	Eagle River	
Olathe	775	Uncompahgre River	

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Community	Estimated Population Served	Receiving Stream	Remarks
COLORADO (Cont'd)			
Ouray	790	Uncompaghre River	
Paonia	1,250	N. Fork Gunnison River	
Redcliff	590	Turkey Creek to Eagle River	
Ridgway	80	Uncompahgre River	
Silverton	820	Animas River	
Telluride	275	San Miguel River	
UTAH			
Ferron	160	Ferron Creek to San Rafael River	
Helper	3,000	Price River	
Huntington	400	Huntington Creek to San Rafael River	

TABLE I (Cont'd)

Community	Estimated Population Served	Receiving Stream	Remarks
UTAH (Cont'd)			
Hurricane	450	Virgin River	
Orangeville	570	Cottonwood Creek to San Rafael River	
Price	7,000	Price River	
Wellington	850	Price River	
NEW MEXICO			
None			
NEVADA			
Bunkerville	300	Virgin River	
Panaca	300	Virgin River	

TABLE I (Cont'd)

Community	Estimated Population Served	Receiving Stream	Remarks
ARIZONA			
Yuma	20,000	Colorado River	
(Gila River Basin not included)			
CALIFORNIA			
None			

TABLE II

Communities In The Colorado River Basin
With Primary Treatment Facilities
December 1965

Community	Estimated Population Served	Receiving Stream	Remarks
WYOMING			
Granger	160	Hams Fork to Blacks Fork	
COLORADO			
Bond	75	Colorado River	
Collbran	200	Plateau Creek	
Cortez *	5,100	McElmo Creek	
Glenwood Springs *	4,300	Colorado River	
Hayden	800	Yampa River	
Mesa	50	Plateau Creek	

* Operation and maintenance problems exist

TABLE II (Cont'd)

Community	Estimated Population Served	Receiving Stream	Remarks
COLORADO (Cont'd)			
New Castle	500	Colorado River	
Oak Creek *	600	Oak Creek to Yampa River	
Rangley	1,200	White River	
Rifle *	2,000	Colorado River	
Silt	450	Colorado River	
Steamboat Springs *	2,000	Yampa River	
Uravan	900	San Miguel River	
Vancorum	60	San Miguel River	
UTAH			
Castle Dale	625	Cottonwood Creek to San Rafael River	

* Operation and maintenance problems exist

TABLE II (Cont'd)

Community	Estimated Population Served	Receiving Stream	Remarks
UTAH (Cont'd)			
Castle Gate	150	Price River	
Clear Creek	100	Price River	
Columbia	375	Price River	
Duchesne	600	Duchesne River	
Hiawatha	430	Miller Creek to Price River	
Kenilworth	250	Wash to Price River	
Latuda	60	Price River	
Myton	330	Duchesne River	
Roosevelt *	2,000	Dry Gulch to Uinta River	
Royal	75	Price River	

* Operation and maintenance problems exist

TABLE II (Cont'd)

Community	Estimated Population Served	Receiving Stream	Remarks
UTAH (Cont'd)			
Castle Gate	150	Price River	
Clear Creek	100	Price River	
Columbia	375	Price River	
Duchesne	600	Duchesne River	
Hiawatha	430	Miller Creek to Price River	
Kenilworth	250	Wash to Price River	
Latuda	60	Price River	
Myton	330	Duchesne River	
Roosevelt *	2,000	Dry Gulch to Uinta River	
Royal	75	Price River	

* Operation and maintenance problems exist

TABLE II (Cont'd)

Community	Estimated Population Served	Receiving Stream	Remarks
NEW MEXICO			
Gamerco	600	Rio Puerco River	
Tyrone	75	Dry Arroyo	
NEVADA			
Pioche	1,100	Meadow Valley Wash to Virgin River	
Caliente	1,050	Meadow Valley Wash to Virgin River	
ARIZONA			
Overgaard	500	Silver Creek to Little Colorado River	
Fort Defiance	900	Quartzite Canyon-Black Creek-Rio Puerco River to Little Colorado River	
Sawmill	400	Quartzite Canyon-Black Creek-Rio Puerco River to Little Colorado River	

TABLE II (Cont'd)

Community	Estimated Population Served	Receiving Stream	Remarks
ZONA (Cont'd)			
t. Michaels	600	Wash - Black Creek - Rio Puerco River to Little Colorado	
loen Kopi	80	Moenkopi Wash to Little Colorado River	
atherine Landing	200	Land - Lake Mohave	
(Gila River Basin not included)			
LIFORNIA			
interhaven	65	Colorado River	
lythe	3,500	Colorado River	

TABLE III

Communities In The Colorado River Basin
With Secondary Treatment Facilities
December 1965

Community	Estimated Population Served	Receiving Stream	Remarks
WYOMING			
Pinedale	965 plus tourists	New Fork River	
Marbleton	190	Muddy Creek to Green River	
Big Piney	665	North Piney Creek	
LaBarge	200	Green River	
Green River	3,500	Green River	
Rock Springs	11,000	Bitter Creek	
Lyman	100	Dry Gulch to Blacks Fork	
Mountainview	1,720	Smiths Fork to Blacks Fork	

TABLE III (Cont'd)

Community	Estimated Population Served	Receiving Stream	Remarks
WYOMING (Cont'd)			
Kemmerer	2,030	Hams Fork to Blacks Fork	
Diamondville	400	Hams Fork to Blacks Fork	
Baggs	200	Little Snake River	
COLORADO			
Artesia	320	Dripping White Creek to White River	
Aspen *	1,100	Roaring Fork River	
Bayfield	300	Los Pinos River	
Carbondale	610	Roaring Fork River	
Collbran Job Corps Camp	125	Plateau Creek	

* Operation and maintenance problems exist

TABLE III (Cont'd)

Community	Estimated Population Served	Receiving Stream	Remarks
COLORADO (Cont'd)			
Clifton	900	Colorado River	
Climax	3,500	Ten Mile Creek	
Colorado Rocky Mountain School	170	Unknown	
Craig	4,600	Yampa River	
Crested Butte Sanitary District	340	Slate River to East River	
Delta	4,000	Uncompahgre River	
Dillon	200	Blue River	
Dolores	810	Dolores River	
Dove Creek	1,200	Montezuma Creek	
Durango	11,000	Animas River	

Community	Estimated Population Served	Receiving Stream	Remarks
COLORADO (Cont'd)			
Eagle	550	Eagle River	
Gilman	300	Fall Creek to Eagle River	
Gunnison	4,000	Tomichi Creek	
Grand Junction * (2 plants)	23,000	Colorado River	
Granby	1,000 avg.	Colorado River	
Grand Lake	1,300 avg.	Shadow Mountain Reservoir	
Gypsum	360	Eagle River	
Ignacio-Ute Agency	930	Los Pinos River	
Kremmling	1,000	Muddy Creek to Blue River	

* Operation and maintenance problems exist

TABLE III (Cont'd)

Community	Estimated Population Served	Receiving Stream	Remarks
COLORADO (Cont'd)			
Mancos	830	Mancos River	
Meeker	1,650	White River	
Montrose	5,050	Uncompahgre River	
Naturita	800	San Miguel River	
Norwood	440	Naturita Creek	
Nucla *	800	Calamity Draw to San Miguel River	
Pagosa Springs	1,500	San Juan River	
Palisade	1,000	Colorado River	
Rifle Mines	25	Colorado River	
Tabernash	500	Fraser River	

* Operation and maintenance problems exist

Community	Estimated Population Served	Receiving Stream	Remarks
COLORADO (Cont'd)			
Vail Village	1,500	Eagle River	
West Glenwood Springs (San. District)	450	Colorado River	
UTAH			
Dutch John	1,000	Green River	
Vernal	3,600	Ashley Creek to Green River	
Whiterocks	175	Uinta River	
Ft. Duchesne Agency	200 plus 150 on 8 hr.	Uinta River	
Sunnyside	1,750	Grassy Trail Creek to Price River	
Dragerton	3,000	Grassy Trail Creek to Price River	
Green River	1,100	Colorado River	

TABLE III (Cont'd)

Community	Estimated Population Served	Receiving Stream	Remarks
UTAH (Cont'd)			
Moab *	6,500	Colorado River	
Aneth	225	San Juan River	
Monticello	1,300	Montezuma Creek	
Blanding	1,300	San Juan River	
Mexican Hat	400	San Juan River	
Kanab	1,500	Kanab Creek	
St. George	4,000	Virgin River	
NEW MEXICO			
Dulce	500	Armago River to Navajo River	
Kutz Compressor Station	55	San Juan River	

* Operation and maintenance problems exist

TABLE III (Cont'd)

Community	Estimated Population Served	Receiving Stream	Remarks
NEW MEXICO (Cont'd)			
Blanco Gas Plant	300	San Juan River	
Bloomfield	750	San Juan River	
Aztec	4,200	Animas River	
Farmington	18,000	San Juan River	
San Juan River Plant, El Paso Natural Gas	235	San Juan River	
Fruitland	150	San Juan River	
Crown Point	1,000	Chaco River	
Shiprock	2,500	San Juan River	
Crystal	250	Chinle Creek	
Ramah	150	Zuni River to Little Colorado River	

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TABLE III (Cont'd)

Community	Estimated Population Served	Receiving Stream	Remarks
NEW MEXICO (Cont'd)			
Continental Divide	Unknown	Rio Puerco River to Little Colorado River	
Fort Wingate	200	Rio Puerco River to Little Colorado River	
El Paso Natural Gas Co., Wingate Plant	160	Rio Puerco River to Little Colorado River	
Wingate Village	300	Rio Puerco River to Little Colorado River	
Rehoboth Mission - Gallup	250	Rio Puerco River to Little Colorado River	
Gallup	11,000	Rio Puerco River to Little Colorado River	
NEVADA			
Las Vegas			
District Plant	33,000	Las Vegas Wash	
City Plant	60,000		
North Las Vegas	11,000	Served by Las Vegas	
Blue Diamond	250	Las Vegas Wash	

TABLE III (Cont'd)

Community	Estimated Population Served	Receiving Stream	Remarks
NEVADA (Cont'd)			
Pittman	250	Served by Henderson	
Henderson	17,000	Las Vegas Wash	
ARIZONA			
Chinle	2,800	Chinle Wash	
Lukachukai	430	Chinle Wash	
Dennehotso	175	Chinle Wash	
Kayenta	1,350	Chinle Wash	
Eagar	700	Served by Springfield	
St. Johns	1,000	Little Colorado River	
Springfield	1,200	Nutrioso Creek to Little Colorado River	
Show Low	900	Show Low Creek - Silver Creek to Little Colorado River	

Community	Estimated Population Served	Receiving Stream	Remarks
ARIZONA (Cont'd)			
Window Rock	1,400	Black Creek - Rio Puerco to Little Colorado River	
School & Teachers Housing, Window Rock	800	Black Creek - Rio Puerco to Little Colorado River	
Holbrook	3,720	Leroux Wash to Little Colorado River	
Ganado	65	Pueblo Colorado Wash to Cottonwood Wash to Little Colorado River	
Greasewood	225	Ganado Wash - Little Colorado River	
Winslow *	7,500	Little Colorado River	
Oraibi	280	Oraibi Wash	
Toreva	30	Wash to Oraibi Wash	

* Operation and maintenance problems exist

Community	Estimated Population Served	Receiving Stream	Remarks
ARIZONA (Cont'd)			
Seba Daiki	175	Oraibi Wash	
Flagstaff	10,000	Padren Canyon - Canyon Diablo	
Hotevilla Bacobi	130	Dinnebito Wash	
Tuba City	2,430	Moenkopi Wash to Little Colorado River	
Kingman	4,000	Dry Wash - Sacramento River to Colorado River	
Bagdad	800	Bill Williams River	
Parker	600	Colorado River	
Someton	200	Irrigation Drainage	

(Gila River Basin not included)

TABLE III (Cont'd)

Community	Estimated Population Served	Receiving Stream	Remarks
CALIFORNIA			
Needles	4,090	Colorado River	
Palo Verde	250	Colorado River	

TABLE IV

SUMMARY OF MUNICIPAL WASTE FACILITIES
COLORADO RIVER BASIN
December 1965

State	No Treatment		Primary Treatment		Secondary Treatment		Communities With Population Over 100 Without Collection Syste	
	Number of Communities	Population Served	Number of Communities	Population Served	Number of Communities	Population Served	Number of Communities	Population
Wyoming	0	0	1	160	11	20,970	7	1,485
Colorado	13	8,330	14	18,235	36	76,160	39	8,850
Utah	7	12,430	11	4,995	14	27,100	55	13,430
New Mexico	0	0	2	675	18	40,000	5	1,585
Nevada	2	600	2	2,150	5	121,500	4	2,650
Arizona	1	20,000	6	2,680	24	40,910	2	1,620
California	0	0	2	3,565	2	4,340	Unknown	Unknown
TOTALS FOR BASIN	23	41,360	38	32,460	110	323,980	112	29,620

TABLE V

Public Health Service
Construction Grant Awards For Sewage Treatment Works
Colorado River Basin

(As of December 1, 1965)

Project Location	Grant Number	Project Description	Estimated Eligible Cost of Project Dollars	Federal Grant Offered Dollars	Project Status
		ARIZONA			
Flagstaff	046	Waste Stabilization Ponds with Appurtenances	208,187	62,450	Completed
Flagstaff	064	Treatment Plant	180,800	52,240	Approved
Holbrook	026	Treatment Plant	80,721	24,210	Completed
Show Low	009	Waste Stabilization Ponds with Appurtenances	133,044	39,910	Completed
Springerville	021	Treatment Plant, Outfall Sewer and Intercepting Sewer	101,421	30,420	Completed
Winslow	005	Treatment Plant and Outfall Sewer	396,585	118,581	Completed
		CALIFORNIA			
Needles	139	Treatment Plant, Outfall Sewer and Intercepting Sewer	415,746	124,720	Completed
		COLORADO			
[redacted]					
Aspen (Aspen San. District)	001	Treatment Plant	171,547	45,332	Completed
Bayfield (Bayfield San. District)	102	Waste Stabilization Ponds with Appurtenances	52,909	15,872	Completed
Craig	021	Waste Stabilization Ponds with Appurtenances	55,071	16,821	Completed

Project Location	Grant Number	Project Description	Estimated Eligible Cost of Project Dollars	Federal Grant Offered Dollars	Project Status
		COLORADO (Cont'd)			
Craig	070	Treatment Plant	198,322	59,496	Completed
Craig San. Dist.	022	Other	22,580	6,744	Completed
Craig	124	Waste Stabilization Ponds with Appurtenances	32,800	9,839	Under Const.
Crested Butte WSD	099	Treatment Plant and Outfall Sewer	69,328	20,798	Completed
Delta	073	Waste Stabilization Ponds with Appurtenances	181,261	54,378	Completed
Dillon (Dillon Improvement Corp.	056	Waste Stabilization Ponds with Appurtenances	45,529	13,659	Completed
Dove Creek San. Dist.	007	Waste Stabilization Ponds with Appurtenances	59,826	17,948	Completed
Durango	027	Treatment Plant, Outfall Sewer and Intercepting Sewer	589,983	176,995	Completed
Eagle S.D.	120	Waste Stabilization Ponds with Appurtenances	52,500	15,750	Approved
Glenwood Spgs. (W. Glenwood Spgs. San. Dist.)	089	Treatment Plant and Intercepting Sewer	100,719	30,215	Completed
Grand Junction	003	Treatment Plant and Outfall Sewer	689,316	206,794	Completed
Gunnison	032	Treatment Plant and Intercepting Sewer	370,133	111,039	Completed
Gypsum	093	Waste Stabilization Ponds with Appurtenances	28,797	8,639	Completed
Meeker San. Dist.	071	Treatment Plant and Intercepting Sewer	187,691	56,307	Completed

TABLE V: (Cont'd)

Project Location	Grant Number	Project Description	Estimated Eligible Cost of Project Dollars	Federal Grant Offered Dollars	Project Status
		COLORADO (Cont'd)			
Montrose	047	Treatment Plant	368,766	110,630	Completed
Naturita San. Dist.	018	Treatment Plant	47,613	14,284	Completed
Nucla San. Dist.	043	Waste Stabilization Ponds with Appurtenances	13,389	4,017	Completed
Pagosa Springs San. Dist.	029	Treatment Plant, Outfall Sewer and Intercepting Sewer	112,092	33,628	Completed
Palisade	068	Waste Stabilization Ponds with Appurtenances	34,539	10,361	Completed
Rifle	130	Addition of Secondary Treatment to existing Primary Plant	78,800	23,640	Approved
		NEVADA			
Boulder City	014	Waste Stabilization Ponds with Appurtenances	454,310	136,290	Completed
Boulder City	027	Intercepting Sewer	141,622	42,480	Completed
Boulder City	038	Intercepting Sewer	120,000	36,000	Approved
Clark (Clark County)	005	Intercepting Sewer	704,253	208,361	Completed
Clark (Clark County)	008	Intercepting Sewer	132,045	39,610	Completed
Henderson	001	Treatment Plant	346,666	104,000	Completed
Las Vegas	002	Treatment Plant	147,019	44,106	Completed
Las Vegas	006	Treatment Plant and Intercepting Sewer	495,787	148,730	Completed

Project Location	Grant Number	Project Description	Estimated Eligible Cost of Project Dollars	Federal Grant Offered Dollars	Project Status
		NEVADA (Cont'd)			
Las Vegas (CCS D1)	010	Intercepting Sewer	62,221	18,660	Completed
Las Vegas (CCS D1)	012	Intercepting Sewer	75,373	22,610	Completed
Las Vegas (CCS D1)	019	Intercepting Sewer	24,183	7,250	Completed
Las Vegas	020	Intercepting Sewer	50,171	15,050	Completed
Las Vegas (CCS D2)	022	Intercepting Sewer	251,903	75,570	Completed
Las Vegas (CCS D1)	024	Intercepting Sewer	19,350	5,800	Completed
Las Vegas (CCS D1)	025	Intercepting Sewer	50,337	15,100	Completed
Las Vegas (CCS D1)	026	Intercepting Sewer	81,067	24,030	Completed
Las Vegas (CCS D1)	031	Intercepting Sewer	105,675	31,700	Completed
Las Vegas	032	Intercepting Sewer	338,862	101,650	Completed
Las Vegas	039	Treatment Plant	2,286,000	600,000	Approved
Las Vegas (CCS D2)	018	Intercepting Sewer	754,253	226,270	Completed
North Las Vegas	007	Intercepting Sewer	75,026	22,507	Completed
North Las Vegas	017	Intercepting Sewer	72,499	21,740	Completed
		NEW MEXICO			
Aztec	007	Treatment Plant, Outfall Sewer and Intercepting Sewer	259,646	63,429	Completed

Project Location	Grant Number	Project Description	Estimated Eligible Cost of Project Dollars	Federal Grant Offered Dollars	Project Status
		NEW MEXICO (Cont'd)			
Bloomfield	024	Treatment Plant, Outfall Sewer and Intercepting Sewer	119,314	35,794	Completed
Bloomfield	097	Intercepting Sewer	47,615	14,284	Completed
Farmington	009	Intercepting Sewer	56,237	16,871	Completed
Farmington	023	Treatment Plant, Outfall Sewer and Intercepting Sewer	642,761	192,828	Completed
Gallup	001	Treatment Plant, Outfall Sewer and Intercepting Sewer	220,687	60,158	Completed
Gallup	031	Treatment Plant	118,803	35,643	Completed
Gallup	075	Treatment Plant	35,343	10,602	Completed
Quemado (Mutual Sewage Works Assn.)	068	Waste Stabilization Ponds with Appurtenances	19,402	9,740 *	Completed
Ramah (Water Sewage Mutual Assn.)	064	Waste Stabilization Ponds with Appurtenances	23,776	10,685 *	Completed
Reserve (Water Sewage Mutual Assn.)	061	Waste Stabilization Ponds with Appurtenances	20,346	6,103	Completed
		UTAH			
Green River	040	Treatment Plant and Outfall Sewer	185,500	87,750	Completed
Kanab	006	Treatment Plant, Outfall Sewer and Intercepting Sewer	157,860	47,358	Completed
Moab	056	Treatment Plant	118,500	35,550	Approved
Monticello	007	Treatment Plant	184,289	55,287	Completed

* Indicates additional funds from APW included

TABLE V[illegible] (Cont'd)

Project Location	Grant Number	Project Description	Estimated Eligible Cost of Project Dollars	Federal Grant Offered Dollars	Project Status
St. George	038	Treatment Plant and Intercepting Sewer	464,227	139,265	Under const.
Vernal	001	Treatment Plant, Outfall Sewer and Intercepting Sewer	313,219	93,966	Completed
Manila	065	Waste Stabilization Ponds with Appurtenances	40,000	12,000	Approved
		WYOMING			
Baggs	027	Waste Stabilization Ponds with Appurtenances	20,961	6,288	Completed
Big Piney	022	Waste Stabilization Ponds with Appurtenances	41,430	12,429	Completed
Diamondville	052	Waste Stabilization Ponds with Appurtenances	20,417	9,675 *	Completed
Green River	047	Waste Stabilization Ponds with Appurtenances	118,950	35,685	Completed
Kemmerer	050	Waste Stabilization Ponds with Appurtenances	197,000	97,500 *	Completed
Lyman	033	Waste Stabilization Ponds with Appurtenances	12,850	3,855	Completed
Pinedale	002	Waste Stabilization Ponds with Appurtenances	59,452	17,836	Completed
Rock Springs	055	Intercepting Sewer	33,560	10,068	Completed
Rock Springs	025	Intercepting Sewer	29,131	8,739	Completed
Rock Springs	046	Intercepting Sewer	22,709	6,813	Completed

* Indicates additional funds from APW included

TABLE VI

Industrial and Mining Pollution Sources
In The Colorado River Basin
December 1965

Industry Name and Location	Product	Nature of Waste	Waste Treatment or Control	Receiving Stream	Remarks
WYOMING					
Green River					
Union Pacific Railroad Yards	--	Oils, greases, phenols	Flotation, settling, skimming	Green River	
Stauffer					
Stauffer Chemical Company	Soda ash	Tailings, dissolved salts	Ponding	Green River (no waste reaches river)	
Westvaco:					
FMC Corporation Trona Mine & Refinery	Soda ash	Tailings pile, dissolved solids, sediment	Ponding	Blacks Fork (no waste reaches stream)	
Kemmerer					
FMC Corporation Coke Research Facility	--	Organic chemical	Ponding	Blacks Fork	
COLORADO					
Pirle					
Union Carbide Corporation	Uranium and vanadium concentrate	Radioactive, acidic, chemical	Ponding (ponds overflow and seep)	Colorado River	

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Industry Name and Location	Product	Nature of Waste	Waste Treatment or Control	Receiving Stream	Remarks
COLORADO (Cont'd)					
Rifle (Cont'd)					
Union Carbide Corporation (old mill inactive)	Uranium and vanadium concentrate	Tailings	Dike containment (erosion to stream occurs)	Colorado River	
Climax					
Climax Molybdenum Corporation	Molybdenum	Tailings	Coagulation, ponds	Ten Mile Creek to Blue River	
Grand Junction					
Climax Uranium Reduction Co.	Uranium and vanadium concentrate	Radioactive, acidic, chemical, organic	Ponding (No overflow, however seepage occurs)	Colorado River	
Western Meat Packers	Meat	Solids, blood, paunch manure, offal	Septic tank	Colorado River	
Grand Valley Rendering Co.	Fats	Solids, fats	Undetermined	Colorado River	
Gunnison					
Kerr McGee Oil Industries (mill inactive)	Uranium concentrate	Tailings	Dike containment	Gunnison River (no waste reaches river)	

TABLE VI (Cont'd)

Industry Name and Location	Product	Nature of Waste	Waste Treatment or Control	Receiving Stream	Remarks
COLORADO (Cont'd)					
Olathe					
Western Slope Rendering Co.	Fats, soaps	Solids, fats	Undetermined	Gunnison River	
Delta					
Holly Sugar Co.	Sugar	Solids, wash water	None	Gunnison River	
Skyland Frozen Food Products	Food	Solids	Municipal system, waste frequently by-passed	Uncompahgre River	
Speas Vinegar Company	Vinegar	Solids	Municipal system, waste frequently by-passed	Uncompahgre River	
Fruita					
Brach Packing Company	Meat	Solids, blood, paunch manure, offal	Undetermined	Colorado River	
American Gilsonite Company	Petroleum	Organic chemicals	Ponding	Reed Wash to Colorado River	
Rico					
Rico Argentine Mill and Sulfuric acid plant	Lead, zinc silver, sulfuric acid	Tailings, sediment, chemicals	Ponding toxic	Dolores River	

TABLE VI (Cont'd)

Industry Name and Location	Product	Nature of Waste	Waste Treatment or Control	Receiving Stream	Remarks
COLORADO (Cont'd)					
Slick Rock					
Union Carbide Corporation (mill inactive	Uranium concentrate	Tailings	None (tailings erode to river)	Dolores River	
Telluride					
Idarado Mining Company	Lead, zinc, silver	Tailings, sediment, toxic chemicals	Ponding	San Miguel River	
Naturita					
Vanadium Corp. of America	Uranium and vanadium concentrate	Uranium mill tailings	None (tailings erode to river)	San Miguel River	
Uravan					
Union Carbide Corporation	Uranium and vanadium concentrate	Radioactive, acidic, chemical	Ponding and chemical treatment (some over-flow and seepage)	San Miguel River	
Silverton					
Standard Metals Corporation	Lead, zinc, silver	Tailings, sediment, toxic chemicals	Ponding	Animas River	

TABLE VI (Cont'd)

Industry Name and Location	Product	Nature of Waste	Waste Treatment or Control	Receiving Stream	Remarks
COLORADO (Cont'd)					
Durango					
Vanadium Corp. of America (mill inactive)	Uranium concentrate	Tailings	None	Animas River (no wastes reach river	
Basin Meat Packing Company	Meat	Solids, blood, paunch manure, offal	Undetermined	Animas River	
Craig					
Big Country Meat Processing Co.	Meat	Solids, blood, paunch manure, offal	Waste hauling	Yampa River	
Hayden					
Colorado Ute Generating Plant	Elec-tricity	Cooling water	None	Yampa River	
Moffat County					
Texas Company Moffat Oil Field	Petroleum	Crude oil, brines, sediment	Ponding	Williams Fork	
Maybelle					
Union Carbide Corp. (mill inactive)	Uranium concentrate	Tailings	None	Johnson Wash to Lay Creek(no waste reaches stream	

Industry Name and Location	Product	Nature of Waste	Waste Treatment or Control	Receiving Stream	Remarks
COLORADO (Cont'd)					
Rangley					
Rangley Oil and Gas Field	Petroleum	Crude oil, brines, sediment	Ponding	White River	
Carbondale					
Thompson Coal Company	Coal	Coal washings	None	Tributary to Crystal River	
UTAH					
Jensen					
Uintah Oil Refinery	Petroleum	Oil, solvents, misc. chemicals	Undetermined	Green River	
Vernal					
San Francisco Chemical Co.	Potash	Slurry, sediments	Ponding	Big Brush Creek to Green River	
Standard Oil	Petroleum	Crude Oil	[illegible]	Rock Creek to Duchesne River	
Ouray					
Gulf Oil Corp. Wonsits Valley Development	Petroleum	Crude oil	Ponding	Green River	
Hanna					
Defa Sawmill	Lumber	Sawdust	None	Duchesne River	

Industry Name and Location	Product	Nature of Waste	Waste Treatment or Control	Receiving Stream	Remarks
UTAH (Cont'd)					
Castle Gate					
Utah Power & Light Company	Electricity	Boiler blowdown and sediment from coal piles	Blowdown ponded	Price River	
Independent Coal & Coke Co.	Coal	Coal washings, sediment	Ponding, (sediment hauled and dumped in Willow Creek)	Willow Creek	
Wellington					
Knight Ideal Coal Company	Coal	Coal washings, sediment	None	Flood Wash to Price River	
Carbon Dioxide Chemical Company	Dry ice	Copper sulfate, organics	None	Flood Wash to Price River	
Carbon County					
Three States Natural Gas Co.	Natural gas	Sediment	Ponding, pits	Scofield Reservoir and tributaries	
Green River					
Union Carbide Corporation (mill inactive)	Uranium concentrate	Tailings	Dike, containment (tailings erode to wash)	Browns Wash to Green River	

Industry Name and Location	Product	Nature of Waste	Waste Treatment or Control	Receiving Stream	Remarks
UTAH (Cont'd)					
Moab Atlas Minerals Corporation	Uranium concentrate	Radioactive, chemicals	Ponding and chemical treatment	Colorado River	
Texas Gulf Sulfur Co.	Potash	Sodium chloride	Ponding	Colorado River (no waste discharge to river)	
Monticello Atomic Energy Commission (mill inactive)	Uranium concentrate	Tailings	Dike containment and earth cover	South Creek (no waste reaches creek)	
Mexican Hat Atlas Minerals Corporation (Uranium mill inactive - acid plant operating)	Uranium concentrate and sulfuric acid	Tailings, cooling water	None (tailings erode to river)	San Juan River	
Monument Valley Vanadium Corp. of America	Uranium concentrate	Tailings	None	Chinle Creek (no waste reaches creek)	
NEW MEXICO					
Shiprock Vanadium Corp. of America	Uranium concentrate	Tailings, chemical	Dike containment, ponding	San Juan River	

Industry Name and Location	Product	Nature of Waste	Waste Treatment or Control	Receiving Stream	Remarks
ARIZONA					
(Gila Basin not included)					
Yuma					
Hague Produce Company	Food	Organic	None	Colorado River	
Tuba City					
El Paso Natural Gas Company	Uranium concentrate	Tailings, chemical	None for tailings, dike containment for liquid	Moenkopi Wash (no waste reaches stream)	
NEVADA					
Henderson					
American Potash & Chemical Corp.	Sodium chlorates, perchlorates, battery active manganese dioxide	Tailings and miscellaneous chemicals	Ponding	Las Vegas Wash	
Stauffer Chemical Company	Chlorine, caustic soda, agriculture chemicals, muratic acid, chloral, monochlorobenzene	Tailings and miscellaneous chemicals	Ponding	Las Vegas Wash	

Industry Name and Location	Product	Nature of Waste	Waste Treatment or Control	Receiving Stream	Remarks
NEVADA (Cont'd)					
Henderson (Cont'd)					
Titanium Metals Corporation of America	Titanium metals, sponge and ingots	Tailings and miscellaneous chemicals	Ponding	Las Vegas Wash	
The Flintkote Company	Lime	Tailings and miscellaneous chemicals	Ponding	Las Vegas Wash	
East Las Vegas					
Nevada Power Company	Electricity	Boiler blowdown	None	Las Vegas Wash	
CALIFORNIA					
Information not known at this date					

TABLE V/I

Streams In The Colorado River Basin Where Fish Stocking Has Been Stopped or Limited Due To Polluted Waters

December 1965

Major Subbasin and Stream Affected	Sources of Pollution
GREEN RIVER SUBBASIN	
Williams Fork, Yampa River, Hamilton, Colorado downstream	Oil drilling
White River below Rangley	Oil drilling
Price River	Improper range management, municipal, and miscellaneous industrial
UPPER MAIN STEM	
Ten Mile Creek, Climax to Dillon, Colorado	Mine tailings and acid mine drainage
Dolores River below Uravan	Uranium processing
Dolores River, Rico to Bear Creek	Acid processing
Red Mountain Creek above Ouray	Natural acidity and mine tailings
Mineral Creek	Natural acidity
Cement Creek	Natural acidity and mine drainage
Colorado River below Rifle, Colorado	Uranium processing, high silt load, water diversion
Eagle River, Minturn area	Old mine tailings

Table VI - Upper Main Stem, continued

Major Subbasin and Stream Affected	Sources of Pollution
Uncompahgre River below Ouray	Old mine tailings
San Miguel River, Telluride area	Old mine tailings
Animas River, all	Old mine tailings

TABLE VIII

Waste Water Disposal Practices
at
Federal Installations in the Colorado River Basin
(Includes Only Those Installations Discharging to Surface Streams)

Installation[1]	Department Agency	Sewage Volume[2]	Sewage % Treated[3]	Industrial Wastes Volume[2]	Industrial Wastes % Treated[3]	Receiving Body
ARIZONA						
Apache County						
Fort Defiance						
Fort Defiance Subagency	Interior Bureau of Indian Affairs	70,000	100			Tse Bonito
McNary						
Williams Creek Fish Hatchery	Interior Fish & Wildlife Service			4,030,400*	0	Williams Creek
Apache National Forest	Agriculture Forest Service	200p	0			Luna Lake
Coconino County						
Tuba City						
Moencopi Day School	Interior Bureau of Indian Affairs	2,100	100			Moencopi Wash
Mohave County						
No City						
Davis Dam	Interior Bureau of Reclamation	900	100			Colorado River

*Is not considered industrial waste.

TABLE VIII Cont'd

Installation	Department Agency	Sewage Volume	Sewage % Treated	Industrial Wastes Volume	Industrial Wastes % Treated	Receiving Body
ARIZONA Cont'd						
Mohave County Cont'd						
No City						
Boulder Canyon Powerplant	Interior Bureau of Reclamation	6,000	100			Colorado River
Navajo County						
Holbrook						
Kachina Point	Interior National Park Service	3,351	100			Puerco River
Hotevilla						
Hotevilla Day School	Interior Bureau of Indian Affairs	2,400	100			Orabi Wash
Keams Canyon						
Agen Headquarters Boarding School	Interior Bureau of Indian Affairs	21,100	100	4,000	0	Keams Wash
Polacca						
Polacca Day School	Interior Bureau of Indian Affairs	4,620	100			Polacca Wash
No City						
Hopi Day School	Interior Bureau of Indian Affairs	5,550	100			Oraibi Wash

Installation	Department Agency	Sewage Volume	Sewage % Treated	Industrial Wastes Volume	Industrial Wastes % Treated	Receiving Body
ARIZONA Cont'd						
Navajo County Cont'd						
No City						
Second Mesa Day School & Hospital	Interior Bureau of Indian Affairs	5,100	100			Polacca Wash
Yuma County						
Yuma						
YCWU Association Headquarters	Interior Bureau of Reclamation	3,600	0			Colorado River
Yuma Field Office	Justice International Boundary and Water Commission	80	0			Colorado River
CALIFORNIA						
Imperial County						
Winterhaven						
Yuma Project	Interior Bureau of Reclamation	1,200 100	0 0			Colorado River Yuma Main Canal
San Bernadino County						
Parker Dam						
Parker Davis Project	Interior Bureau of Reclamation	800	100			Colorado River

TABLE VIII Cont'd

Installation	Department Agency	Sewage Volume	Sewage % Treated	Industrial Wastes Volume	Industrial Wastes % Treated	Receiving Body
COLORADO						
Grand County						
No City						
Rocky Mountain National Park	Interior National Park Service	6,000	100			Lake Grandby
No City						
Hidden Valley Winter Area	Interior National Park Service	4,500	100			Hidden Valley Creek
Eagle County						
Redcliff						
Camp Hale	Defense Army	130,000	100			Eagle River
Mesa County						
Grand Junction	Atomic Energy Commission	400	0	6,000*	0	Gunnison River
Grand Junction, AEC Operations Office						
LaPlata County						
Ignacio						
Ignacio Dormitories	Interior Bureau of Indian Affairs	25,000	100			Pine River

*Lagoon system now receives wastes which are 20% cooling water.

TABLE VIII Cont'd

Installation	Department Agency	Sewage Volume	Sewage % Treated	Industrial Wastes Volume	Industrial Wastes % Treated	Receiving Body
NEVADA						
Clark County						
Boulder City						
Boulder Canyon Powerplant	Interior Bureau of Reclamation	6,000	100			Colorado River
NEW MEXICO						
San Juan County						
Bloomfield						
Chaco Canyon National Monument	Interior National Park Service	200	0			Chaco Wash
Shiprock						
San Juan Boarding School	Interior Bureau of Indian Affairs	5,000	100			San Juan River
McKinley County						
Gallup						
Fort Wingate Ordnance Depot	Defense Army	15,400	100			Rio Puerco
UTAH						
Unitah County						
Fort Duchesne						
Unitah & Ouray Indian Agency	Interior Bureau of Indian Affairs	50,000	100			Unitah River

1/ Data from the 1962 inventory.

2/ Volume is in gallons per day, except where a "p" is entered, and this represents number of persons served by the facility.

3/ This figure represents the percentage of the volume of waste, shown in the preceeding column, which received treatment prior to discharge.